Hei 7-135214 discloses a technology for selectively radiating electron-beams using a mask 41 shown in Fig. 9 during the manufacturing processes in order to avoid the generation of the parasitic diode. The beams pass through through-holes 43 formed in the mask 41 and irradiate on the IGBT 80. In this way, the life-time of carriers located on the plane of the PN junction 59 where the parasitic diode being generated can be shortened as a result of forming crystal defects 61.--

Please replace the paragraph beginning at page 2, line 13, with the following rewritten paragraph:

--In the manufacturing processes described above, unexpected variation of the threshold voltage in the IGBT 80 is possible because of generation of bremsstrahlung caused by the material of the mask 41 made generally of a heavy metal such as lead and the like.--

Please replace the paragraph beginning at page 2, line 18, with the following rewritten paragraph:

--Japanese Patent laid-open publication No. Hei 8-227895 discloses another IGBT 90 having layers for restricting electron-beams. As shown in Fig. 10, a layer 69 made of silicon nitride for restricting the beams is formed under a source electrode. Generation of bremsstrahlung is restricted even when the beams are radiated to the IGBT 90 due to masking by the restriction layer 69.--

Please replace the paragraph beginning at page 3, line 1 with the following rewritten paragraph:

--However, the number of processes is increased because the processes for forming the restriction layers 69 made of silicon nitride is required in the conventional method.--

Please replace the paragraph beginning at page 3, line 6, with the following rewritten paragraph:

--It is an object of the present invention to overcome the above mentioned drawbacks associated with the prior art, and to provide a semiconductor device and a method for manufacturing thereof capable of radiating electron-beams to the desired region with simple processes, while not providing adverse effects caused by bremsstrahlung even when the electron-beams are radiated.--

Please replace the paragraph beginning at page 3, line 13, with the following rewritten paragraph:

C7 --In accordance with characteristics of the present invention, there is provided a semiconductor device comprising:--

Please replace the paragraph beginning at page 3, line 18, with the following rewritten paragraph:

C8 --a metal wiring layer located on the substrate one of directly and indirectly,--

Please replace the paragraph beginning at page 3, line 20, with the following rewritten paragraph:

C9 --wherein the metal wiring layer is made of a light metal,--

Please replace the paragraph beginning at page 3, line 22, with the following rewritten paragraph:

C10 --and wherein the metal wiring layer located on the region to be irradiated is formed thinner than that formed on regions except for the region to be irradiated.--

Please replace the paragraph beginning at page 3, line 25, with the following rewritten paragraph:

C10 --Also, in accordance with characteristics of the present invention, there is provided a semiconductor device comprising:--

Please replace the paragraph beginning at page 4, line 4, with the following rewritten paragraph:

C11 --a metal wiring layer located on the substrate,--

Please replace the paragraph beginning at page 4, line 5, with the following rewritten paragraph:

C12 --wherein the metal wiring layer is made of a light metal,--

Please replace the paragraph beginning at page 4, line 7, with the following rewritten paragraph:

C13 --and the metal wiring layer is used as a mask for restricting penetration of the radiating rays into regions except for the region to be irradiated.--

Please replace the paragraph beginning at page 5, line 11, with the following rewritten paragraph:

C14 --Fig. 5A and Fig. 5B are other sectional views showing the manufacturing process of the IGBT 1.--

Please replace the paragraph beginning at page 5, line 13, with the following rewritten paragraph:

C15

--Fig. 6A and Fig. 6B are yet other sectional views showing the manufacturing process of the IGBT 1.--

Please replace the paragraph beginning at page 5, line 15, with the following rewritten paragraph:

C14

--Fig. 7A and Fig. 7B are still other sectional views showing the manufacturing process of the IGBT 1.--

Please replace the paragraph beginning at page 6, line 4, with the following rewritten paragraph:

C17

--The IGBT 1 is formed on a substrate 2 for a semiconductor device. In the substrate 2, an n^+ type layer 5 and an n^- type layer 7 are consecutively formed on a drain layer 3 with P^+ type. A base region 21 with P^+ type is formed in the n^- type layer 7. Source regions 23 are formed in the base region 21. The surface of the n^- type layer 7 is covered with a gate oxidation layer 15. A gate electrode 17 is formed on the gate oxidation layer 15. The gate electrode 17 is covered with an inter-insulating layer 19, and a source electrode 22 made of aluminum is formed on the inter-insulating layer 19. The source electrode 22 formed as a wiring layer made of a metal is also used for electrically connecting with the source regions 23 in the IGBT element. A passivation layer 29 covers the entire surface of the source electrode 22. The first conductive type and the second conductive type are respectively defined as n type and p type in this embodiment.--

Please replace the paragraph beginning at page 6, line 22, with the following rewritten paragraph:

C18

--A silicon oxidation layer 27 is formed on a region 24 located between the source regions 23 formed within the base regions 21. Further, the source electrode 22 is not present at an upper part of the silicon oxidation layer 27, and an opening 25 is located on the silicon oxidation layer 27. On the other hand, a crystal defect region 11 is formed at a position in the n^- type layer 7 and below the silicon oxidation layers 27.--

Please replace the paragraph beginning at page 7, line 4, with the following rewritten paragraph:

--Fig. 2 is a perspective view of the IGBT 1 before forming the passivation layer 29. As described, the silicon oxidation layer 27 is formed above the crystal defect region 11, and the opening 25 is located on the silicon oxidation layers 27. In this way, the source electrode 22 made of aluminum can be used both for a wiring, and a mask for the beams.--

Please replace the paragraph beginning at page 7, line 11, with the following rewritten paragraph:

--Next, a method for manufacturing the IGBT 1 will be described. The manufacturing processes similar to an ordinary IGBT are carried out until forming the source electrodes 23. In other words, the substrate 2 is formed by consecutively forming the n^+ type layer 5 on the drain layer 3 and the n^- type layer 7 thereon as shown in Fig. 4A. Thereafter, the gate oxidation layer 15 and the gate electrode 17 are formed successively as shown in Fig. 4B. Ion implantation of P-type impurities is carried out by using the gate electrode 17 as a mask. Further, N-type impurities are implanted ionically by using both resist layers 81 formed on the gate oxidation layer 15 and the gate oxidation layers 17 as a mask as shown in Fig. 4C. The base region 21 with P^+ type and a pair of the source regions 23 located in the base region 21 are formed simultaneously by carrying out thermal treatment as shown in Fig. 5A.--

Please replace the paragraph beginning at page 8, line 2, with the following rewritten paragraph:

--Next, a silicon oxidation (SiO_2) layer 18 is accumulated entirely on the substrate with the chemical vapor deposition (CVD) method as shown in Fig. 5B. A resist layer 82 is formed above both the crystal defect region 11 and the gate electrode 17 as shown in Fig. 6A. Both the inter-insulation layer 19 and the silicon oxidation layer 27 are formed with an etch-back technique by using the resist layers 82. In this way, the silicon oxidation layer 27 is formed above of the crystal defect region 11 as shown in Fig. 6B.--

Please replace the paragraph beginning at page 8, line 24, with the following rewritten paragraph:

--By carrying out the irradiation, the crystal defect region 11 uncovered with the source electrode 22 is irradiated by the beams, so that desired crystal defects are generated within the region 11. On the other hand, less intensity of the beams are irradiated to regions existing outside of the region 11. Although, a certain amount of crystal defects are generated in the

C22 cont'd

regions existing outside of the region 11, these defects can be removed by annealing carried out later. In this way, the IGBT 1 shown in Fig. 1 is manufactured.--

Please replace the paragraph beginning at page 9, line 8, with the following rewritten paragraph:

C23

--Next, thickness of the source electrode 22 is described hereunder with reference to a relationship between a range of electrons in the source electrode 22 and energy amount of the beams. As shown in Fig. 3, the range of electrons in aluminum is increased when a higher energy is radiated. Usually, energy strength of the beams forming the crystal defect region is in a range from 600 electro-volts to 1 mega electro-volts. The source electrode 22 in thickness of 0.6 cm to 1 cm is required in order to restrict the generation of the crystal defect region with the source electrode 22 alone. However, the source electrode 22, relatively thicker than an ordinary aluminum wiring having a range from 1 μm to 10 μm, is able to restrict the beams because the beams are restricted by the gate electrode 17, the passivation layer 19 and other layers formed thereunder.--

Please replace the paragraph beginning at page 9, line 24, with the following rewritten paragraph:

C24

--Further, the generation of bremsstrahlung caused by the source electrode 22 made of a heavy metal can be avoided even when the beams are directly radiated to the source electrode 22 exposed to the air. Because the source electrode 22 is made of a light metal in this embodiment. In this way, only a desired region is irradiated with beams by using the source electrode made of aluminum capable of being used both as a wiring and a mask for the beams as a result of making an opening at a region to be irradiated without forming a layer for restricting beams in addition to the layers described above.--

Please replace the paragraph beginning at page 10, line 22, with the following rewritten paragraph:

C25

--Although, the source electrode 22 is made of aluminum, other light metals not causing bremsstrahlung such as an aluminum silicon and the like can be used for the source electrode 22. Any other metals not causing bremsstrahlung such as copper can be used for the source electrode 22. Because of its higher density than that of aluminum, the use of copper allows radiation of the beams to the desired region even when its profile is in a thin form. Further, tungsten can also be used for the source electrode 22.--

Please replace the paragraph beginning at page 11, line 10, with the following rewritten paragraph:

C26

--Further, the silicon oxidation layer 27 is provided in order to form the opening 25 located above the crystal defect region 11 in the embodiment. However, the opening can be formed directly on the source electrode 22 by carrying out etching thereto without providing the silicon oxidation layer.--

Please replace the paragraph beginning at page 11, line 16, with the following rewritten paragraph:

C27

--The semiconductor device in accordance with the present invention is characterized in that, the metal wiring layer is made of a light metal. Therefore, no generation of bremsstrahlung is observed even when the radiation is radiated. Also, the metal wiring layer located on the region to be irradiated is formed thinner than that formed on regions except for the region to be irradiated so as to reach the radiating rays to the region to be irradiated. In this way, the crystal defect region can only be formed in the desired region. As a result, it is possible to provide a semiconductor device capable of radiating the radiating rays to the desired region with simple processes, while not providing adverse effects caused by bremsstrahlung even when the radiating rays are radiated. Also, the semiconductor device in accordance with the present invention is characterized in that, the metal wiring layer located on the regions except for the region to be irradiated is formed in a thickness so as not to provide any adverse effect on the regions except for the region to be irradiated. Therefore, it is possible to avoid adverse effect on the regions except for the region to be irradiated.--

Please replace the paragraph beginning at page 12, line 12, with the following rewritten paragraph:

C28

--Further, the semiconductor device in accordance with the present invention is characterized in that, the metal wiring layer is made of a light metal, and the metal wiring layer is used as a mask for restricting penetration of the radiating rays into region except for the region to be irradiated. Therefore, it is possible to provide a semiconductor device capable of receiving the radiating rays only to the desired region with simple processes, while not providing the adverse effects caused by bremsstrahlung even when the radiating rays are radiated.--

Please replace the paragraph beginning at page 13, line 12, with the following rewritten paragraph:

--Further, the method for manufacturing a semiconductor device in accordance with the present invention is characterized in that, the method comprises the steps of entirely forming the metal wiring layer, removing the metal wiring layer located on the region to be irradiated, and radiating the radiating rays using the metal wiring layer remaining as a mask. Therefore, it is possible to provide a semiconductor device capable of radiating the radiating rays only to the desired region with simple processes without causing any adverse effects caused by bremsstrahlung even when the radiating rays are radiated.--

C29

Please replace the paragraph beginning at page 13, line 24, with the following rewritten paragraph:

--The semiconductor device in accordance with the present invention is characterized in that, the metal wiring layer is made of a metal which prevents the generation of bremsstrahlung even when the radiating rays are radiated, and the metal wiring layer located on the region to be irradiated is formed thinner than that formed on regions except for the region to be irradiated so as to reach the radiating rays to the region to be irradiated. In this way, the crystal defect region can only be formed in the desired region. As a result, it is possible to provide a semiconductor device capable of radiating the radiating rays only to the desired region with simple processes, while not providing adverse effects caused by bremsstrahlung even when the radiating rays are radiated.--

C30

In the Claims

Please cancel claims 1-8, without prejudice. Claims 1-7 have been rewritten as the new claims. Claim 8 has been withdrawn as being directed to a non-elected invention and a divisional application may be filed.

Please add claims 9-14, as follows:

9. (New) A semiconductor device comprising:

a substrate having a region irradiated with radiating rays,

crystal defects within the region irradiated, and

a metal wiring layer located over the substrate, the metal wiring layer being made of a light metal, the metal wiring layer having an opening above the region irradiated, so that

C31